

# Dimensionally Stable Structural Space Cable, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



## ABSTRACT

Jet Propulsion Laboratory (JPL) is involved in an ongoing effort to design and demonstrate a full-scale (30-32m diameter) Starshade engineering demonstrator that meets the aggressive deployment dimensional repeatability and stability requirements for exoplanet detection. A key component of the Starshade structural system is a series of dimensionally stable composite cables (or spokes) that connect the center structural hub to the perimeter truss and largely determine the deployed shape and stiffness of the system much like a bicycle wheel. There are many challenges in developing the Starshade spoke. Perhaps most notable is that meeting the CTE requirement necessitates accurate control of fiber volume fraction (resin content) to less than 1%. Also challenging is that meeting the stiffness precision goal of less than 0.5% variation between cables demands that minimal fiber fraying and damage be allowed during the tow spreading and alignment process and that the net cross section be made in one step with no required post-processing. Furthermore, meeting the length precision goal requires uncommon assembly and end fitting bonding methodologies. Finally, there are challenges associated with integrating such high-performance cables into the Starshade while ensuring snag-free deployment and proper on-orbit operation. The DS3 Cable technology addresses all of these challenges with a highly tailorable thermoplastic-tape design that uses Dual Resin Bonding technology for strength and dimensional stability at the end fittings.

## ANTICIPATED BENEFITS

### To NASA funded missions:

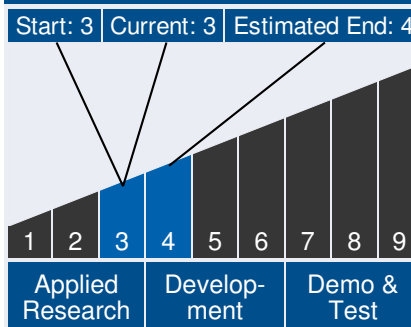
Potential NASA Commercial Applications: -Starshade for Exoplanet-Analysis Missions -Tendon Actuated Lightweight In-Space MANipulators (TALISMAN) manipulator for Asteroid Rendezvous Mission (ARM) -High-Frequency mesh-based antennas for Earth Science (e.g., SMAP follow-on



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## Technology Maturity



## Management Team

### Program Executives:

- Joseph Grant
- Laguduva Kubendran

### Program Manager:

- Carlos Torrez

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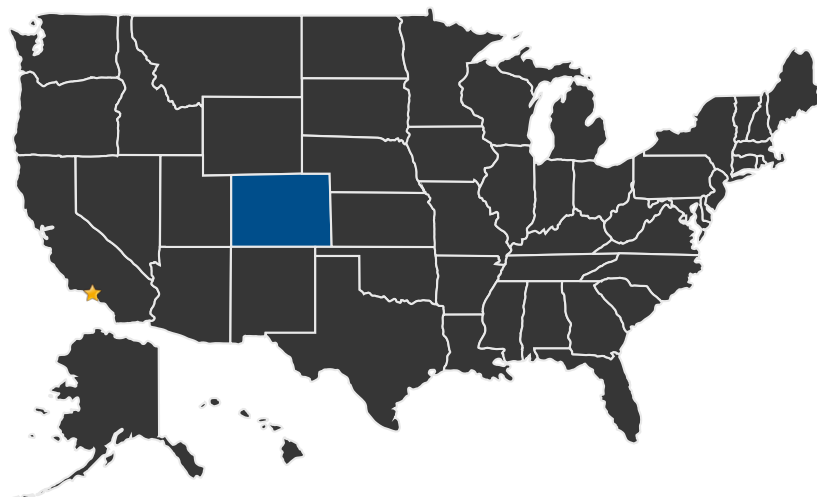


mission) -High-Frequency mesh-based antennas for Evolvable Mars Campaign (e.g. Human Mars)

## To the commercial space industry:

Potential Non-NASA Commercial Applications: -High-Frequency mesh-based antennas for CommSat applications (LEO CubeSat and GEO CommSat)

## U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States  
With Work

★ **Lead Center:**  
Jet Propulsion Laboratory

## Other Organizations Performing Work:

- ROCCOR, LLC (Louisville, CO)

## PROJECT LIBRARY

### Presentations

- Briefing Chart
  - (<http://techport.nasa.gov:80/file/23372>)

### Management Team (cont.)

#### Principal Investigator:

- Thomas Murphey

### Technology Areas

#### Primary Technology Area:

Materials, Structures, Mechanical Systems and Manufacturing (TA 12)

└ Structures (TA 12.2)

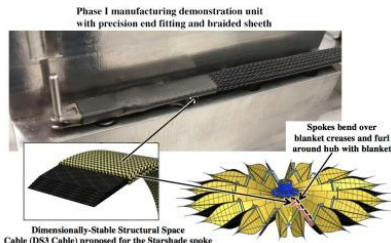
└ Lightweight Concepts (TA 12.2.1)

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## IMAGE GALLERY



*Dimensionally Stable Structural Space Cable, Phase II*

## DETAILS FOR TECHNOLOGY 1

### Technology Title

Dimensionally Stable Structural Space Cable, Phase II

### Potential Applications

-Starshade for Exoplanet-Analysis Missions -Tendon Actuated Lightweight In-Space MANipulators (TALISMAN) manipulator for Asteroid Rendezvous Mission (ARM) -High-Frequency mesh-based antennas for Earth Science (e.g., SMAP follow-on mission) -High-Frequency mesh-based antennas for Evolvable Mars Campaign (e.g. Human Mars)